

Appl. No. 09/718,528  
Amdt. dated June 15, 2004  
Reply to Office action of May 6, 2004

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (currently amended) A method for detecting text in a mixed-content image, said method comprising:
  - identifying an edge associated with a high-contrast intensity change;
  - identifying an intensity gradient direction for said edge;
  - identifying a character stroke axis, wherein said axis is an selected from the group consisting of a stroke valley or a stroke ridge;
  - measuring a ~~spatial relationship~~ substantially transverse distance between said axis and said edge; and
  - identifying said edge as a text edge when said ~~spatial relationship~~ substantially transverse distance ~~conforms to specified criteria~~ is less than a threshold value.
2. (canceled)
3. (canceled)
4. (canceled)
5. (canceled)
6. (canceled)

7. (currently amended) The method of claim 1 wherein said measuring a ~~spatial relationship~~ substantially transverse distance comprises measuring the proximity of an edge to an axis in a direction parallel with said intensity gradient direction.
8. (currently amended) The method of claim 1 wherein said identifying a character stroke axis comprises the acts of:
  - analyzing successive pixels to identify a coincident curvature position wherein a substantial curvature of an intensity map occurs at the same location as a minimal curvature of said intensity map in another direction;
9. (currently amended) The method of claim 1 wherein said measuring a ~~spatial relationship~~ substantially transverse distance comprises the acts of:
  - beginning at a subject pixel that has been identified as an edge and progressively analyzing adjacent pixels in a direction parallel with the intensity gradient of the subject pixel; and
  - analyzing each successive pixel to determine whether said successive pixel has been identified as an axis pixel.
10. (currently amended) A method for detecting text in a mixed-content image comprising:
  - processing said image to identify edge components associated with significant intensity changes;
  - processing said image to identify an intensity gradient direction for each of said edge components;
  - processing said image to identify character stroke axes; wherein said axes are one of a stroke valley or a stroke ridge;

measuring the proximity of said axes to said edge component; and  
  
identifying said edge component as a text edge component when said proximity conforms to  
  
specified proximity criteria.

11. (canceled)

12. (canceled)

13. (original) The method of claim 10 wherein said processing said image to identify axes comprises analyzing successive pixels to identify a coincident curvature position wherein a maximum curvature of an intensity map, said maximum curvature being greater than a threshold value, occurs at the same location as a minimal curvature of said intensity map, said minimal curvature being lower than a specified value and being in a direction approximately perpendicular to said maximum curvature.

14. (currently amended) A method of identifying a text stroke in a mixed-content image based on a partial character sample, said method comprising:  
  
identifying edge image components of an edge associated with a high-contrast intensity change;  
  
identifying an intensity gradient direction for said edge image components;  
  
identifying ~~an axis~~ one of a ridge or a valley proximate to said edge image components;  
  
and  
  
measuring the proximity of said ~~axis~~ one of a ridge or a valley to said edge image components in a direction parallel to said intensity gradient direction.

15. (currently amended) A method for detecting text in a mixed-content image comprising:
- processing said image to identify edge pixels associated with significant intensity changes;
  - processing said image to identify an intensity gradient direction for each of said edge pixels;
  - processing said image to identify ~~axis~~ one of a ridge or a valley pixels having coincident curvature wherein a maximum curvature of an intensity map, centered a subject pixel occurs at the same location as a minimum curvature of said intensity map and wherein said maximum curvature occurs in a direction approximately perpendicular to said minimum curvature;
  - when said coincident curvature position exists, identifying said subject pixel as ~~an axis~~ one of a ridge or a valley pixel;
  - measuring the proximity of said ~~axis~~ one of a ridge or a valley pixel to said edge pixel;
  - and
  - identifying said edge pixel as a text edge pixel when said proximity conforms to specified proximity criteria.
16. (currently amended) An apparatus for detecting text in a mixed-content image, said apparatus comprising:
- an edge detector for detecting image edge components at an edge associated with a high-contrast intensity change in an image;
  - a gradient direction detector for detecting an intensity gradient direction for at least some of said image edge components;

an intensity curvature analyzer for determining the presence of geometric intensity curvature features consisting of a ridge or a valley; and  
a proximity measurer for measuring the proximity of at least one of said features to at least one of said edge components.

17. (original) The apparatus of claim 16 further comprising an identifier for identifying said edge component as a text edge component when said proximity conforms to specified proximity criteria.
18. (currently amended) A computer readable medium for detecting text in a mixed-content image, said method comprising the acts of:  
identifying an image edge component of an edge associated with a high-contrast intensity change in an image;  
identifying an intensity gradient direction for said edge component;  
identifying a geometric intensity curvature feature consisting of a ridge or a valley;  
measuring the proximity of said feature to said edge; and  
identifying said edge component as a text edge component when said proximity conforms to specific proximity criteria.
19. (original) The medium of claim 18 wherein said components are pixels.
20. (original) The medium of claim 18 wherein said identifying a geometric intensity curvature feature comprises an analysis of image components until the change in curvature of the intensity curve between two successive image components in a direction substantially parallel to the intensity gradient direction reaches a maximum absolute value at the same position that the change in curvature of the intensity curve in a direction substantially perpendicular to the intensity gradient direction is near zero.

21. (canceled)
22. (new) A method for detecting text in a mixed-content image, said method comprising:
- a) identifying an edge associated with a high-contrast intensity change;
  - b) identifying an intensity gradient direction for said edge;
  - c) identifying a character stroke axis, wherein said axis is an element in the group consisting of a stroke valley or a stroke ridge;
  - d) wherein said identifying comprises an analysis of image components until the change in curvature of the intensity curve between two successive image components in a direction substantially parallel to the intensity gradient direction reaches a maximum absolute value at the same position that the change in curvature of the intensity curve in a direction substantially perpendicular to the intensity gradient direction is near zero;
  - e) wherein said curvature of the intensity curve is calculated by solving for the eigenvalues of a Hessian matrix;
  - f) measuring a distance, in the intensity gradient direction, between said axis and said edge; and
  - g) identifying said edge as a text edge when said distance is less than a threshold value.